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Adapting to the Elements

Cold, drought, wind, lightning—in fact, all the elements that make up weather—still plague this Nation's producers of food, feed, and fiber. Man has not learned to control weather; but, through agricultural research, he is learning to cope with it.

Scientists even *use* elements of weather—as they did on Guam, where winds of typhoon velocity set the stage for eradicating the island's oriental fruit flies (see page 12).

From the producer's standpoint, however, adjusting to adverse weather conditions isn't simple. In many cases, he must wait for research to provide him with new tools or procedures that will help him adjust. Some new possibilities now being explored are discussed in this issue.

SUBFREEZING COLD cuts production and profits in many fruit and vegetable areas each year. By treating late-maturing cabbage plants with a growth retardant (see page 10), a plant physiologist protected them from winter killing, even though they were stored outdoors all winter in temperatures as low as minus 1° F.

PERIODS OF DROUGHT often prevent establishment of grasses for pasture and hay, partly because they won't emerge if seeded deep enough to be in contact with soil moisture. Agronomists have found strains of intermediate wheatgrass that have long coleoptiles—the part of the plant that first penetrates the soil surface (see page 7). Longer coleoptiles, of course, would permit planting seeds deeper—in moist soil.

HIGH VELOCITY WINDS, like those that have been kicking up dust storms this year in the Southwest, erode away rich soil and pollute the atmosphere. Fields covered with grass—of a long coleoptile variety—not only would resist wind erosion; they might also trap and hold dust blown from unprotected areas (see page 13).

LIGHTNING STRIKES down many farm animals each year; it also causes widespread damage to fencing (see page 14). Scientists have observed that grounded fencing built in 1941, besides protecting livestock all these years, is still in good condition. Ungrounded fencing, installed at the same time, is rusted and pitted.

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BREAKTHROUGH Against Houseflies

Scientists identify feeding stimulant, pave the way for research on new control

■ ARS scientists have isolated and identified feeding stimulants for female houseflies that cause hundreds of the female flies to feed on a small area of filter paper containing less than one-millionth of an ounce of the materials.

The scientists who isolated and tested the feeding stimulants are doing basic research, and all tests have been under laboratory conditions. Other ARS scientists will conduct applied research to determine whether the materials have practical value for controlling houseflies.

Regardless of the outcome of applied research, the identification of these feeding stimulants is important in that it gives investigators a means of more accurately distinguishing between elements in the food supply that satisfy nutritional requirements and those that affect feeding behavior.

Four scientists in the Insect Physiology Pioneering Research Laboratory at Beltsville, Md., isolated and identified the feeding stimulants. They are insect physiologists W. E. Robbins, R. E. Yamamoto, and T. J. Shortino, and chemist M. J. Thompson.

Investigations of the feeding stimulant began after it was noticed that adding yeast hydrolysate or casein hydrolysate to a basic diet sharply increased the feeding activity and the food intake of female flies. Investigations were then begun to determine whether this was due to an attractant or feeding stimulant.

In the months of research that followed, the scientists isolated and tested components from the hydrolysates. They found that guanosine monophosphate (GMP) was the major active component of yeast hydrolysate. Of the three active isomers of GMP, GMP–5 appeared to be the most active. Several amino acids were also found to be extremely active, including leucine (the most active), methionine, lysine, and isoleucine.

As little as 10 micrograms (about three-millionths of an ounce) of GMP–5 or leucine stimulated vigorous feeding and clustering on filter paper.

Apparently none of the feeding stimulants *attracts* flies. When filter paper impregnated with one of the

ABOUT THE COVER—
Flies are tethered on the end of applicator sticks with wax—and then held so that their feet touch the test substances to confirm feeding stimulation.

substances is placed in a cage of the houseflies, random movement of the insects soon brings some of them in contact with the paper. As soon as a female contacts the activated part of the paper, it extends its proboscis and feeds vigorously. This feeding attracts the attention of other flies and, within a few minutes, a cluster of females accumulates on the impregnated part of the paper.

Why the feeding stimulants are so specific for females, and virtually inactive for males, cannot be fully explained, but the scientists believe it is probably correlated with the ovarian development cycle of the female.

Entomologists have long been aware of the practical potential of feeding stimulants and other substances that affect insect behavior, and there have been widespread research efforts to detect, isolate, and identify these substances. The more consistently scientists can influence behavior of an insect, the better will be the opportunities of finding methods to control them.☆

Filter paper treated with a measured amount of stimulant was placed in a cage of houseflies.

Shortly after first female flies located stimulant, large cluster of the females was feeding vigorously.

WHERE THERE'S TOO MUCH SALT...

Corn and tomato roots absorb more water from other zones

■ When part of the root system of corn or tomato plants is exposed to a high concentration of salts, the remainder of the root system absorbs water more rapidly to supply the fresh water that the plant needs.

This finding by ARS soil scientists explains why these crops make normal growth in humid areas of the East after part of the root zone is contaminated by brackish water used in emergency irrigations to prevent drought damage (AGR. RES., July 1964, p. 12).

Soil salinity problems in the humid East differ in some respects from those in the West. Where salinity occurs in western soils, it usually is a permanent problem. In the East, it normally is a temporary condition that occurs after irrigation with brackish water, which deposits salts in the top few inches of soil. Late summer and fall rains leach the salts to a lower soil zone, and winter rains leach them beyond the root zone. By spring planting, the soil is usually no longer saline.

The ability of corn and tomato roots to step up water intake from the saline-free portion of the root zone was revealed in research by Jesse Lunin and M. H. Gallatin, working in cooperation with the Virginia Truck Experiment Station. They divided the root area of corn and tomato plants into three zones—top, middle, and bottom—and irrigated them with different combinations of fresh water and synthetic sea water.

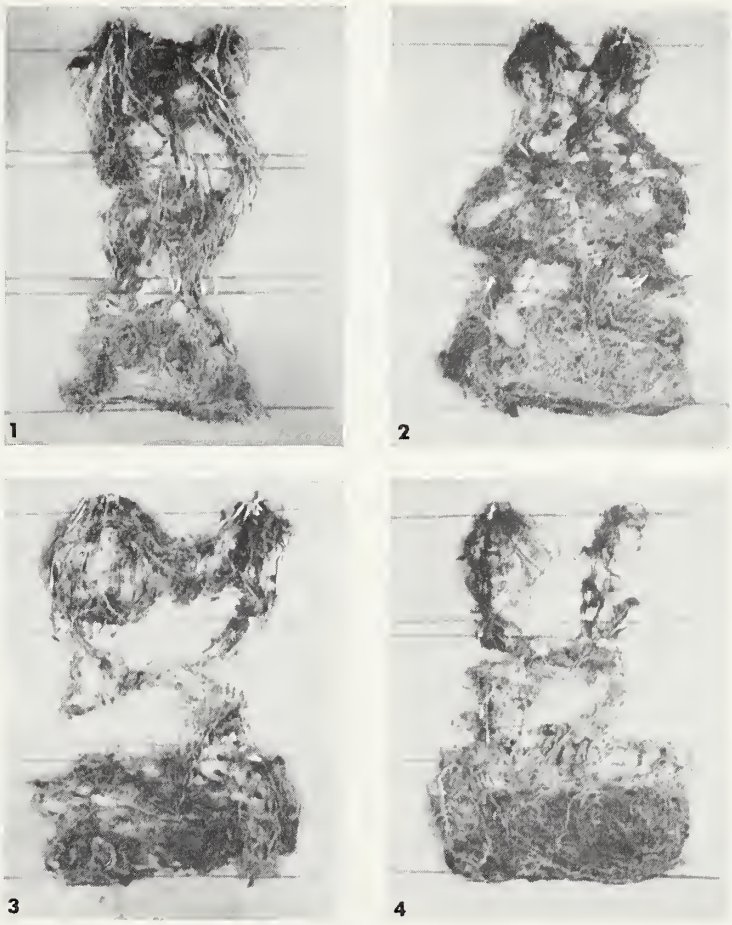
The plants were grown in plywood boxes in Portsmouth fine sandy loam, separated into the three horizontal soil zones with ½-inch layers of coarse sand. The sand prevented water from moving by capillarity from one soil zone to another, yet allowed plant roots to penetrate each zone. When the roots reached the bottom zone, the surface of the soil was sealed with plastic film to eliminate evaporation.

The zones were irrigated individually through porous ceramic tubes that were embedded in each zone and connected with rubber tubing to graduated-cylinder reservoirs. When the reservoirs were filled with water, the soil zones were irrigated automatically—and the water absorbed by plant roots was accurately measured.

When synthetic sea water was substituted for demineralized irrigation water in the top zone, the plants decreased their water uptake from that zone but increased their uptake from the middle zone. When both the top and middle zones were salinized, the plants increased their water uptake from the bottom zone.

Water uptake by tomatoes with one zone salinized was slightly less than water uptake by plants in nonsalinized soil. When two zones were salinized, the uptake was reduced considerably.

Salinization of two zones only slightly reduced water uptake by corn.☆



Growth of corn roots follows a pattern in salinization studies. Where fresh water was used to irrigate corn, root growth was uniform in all zones (1). Where zones were irrigated with synthetic sea water—top zone (2), middle zone (3), top and middle zone (4)—root growth diminished.

Broadening Horizons for Crambe Oil

- In continuous steel casting
- In new kinds of nylon
- In waxes comparable to beeswax
- In plasticizers that keep plastics flexible

■ Acreage planted to crambe in 1965 will be increased more than sixfold—from about 550 acres in 1964 to 3,500 this year—largely because of a broadening of potential industrial applications for crambe seed oil.

Adaptable in many areas where wheat is grown, crambe yields an oil that contains 55 to 60 percent of erucic acid, which is now obtained from imported rapeseed oil. Erucic acid is a source of chemicals used in plastics, lubricants, resins for paint, and other industrial products.

Specifically, crambe oil or its components are now being evaluated—(1) by the steel industry for use in continuous casting, (2) for plastics industry use in two new kinds of nylon and as plasticizers that keep certain plastics flexible in cold weather, and (3) for wax industry use in waxes that are comparable with commercial beeswax.

Introduced into U.S. agriculture by ARS crops researchers, crambe is being evaluated by the Northern utilization research laboratory as an industrial oilseed that shows promise in applications where other U.S. farm products are not used. Crambe is in the same plant family as rape and mustard.

The 1965 crambe crop will be grown by western and midwestern farmers under contract with cooperating companies, which will process oil from the seed and supply samples of seed, oil, and meal to crops and utilization researchers. They will also make available information on crop yields and oil processing and refining.

Cooperating farmers in Idaho, Montana, Nebraska, Oregon, Wisconsin, and Wyoming planted the 550 acres in 1964. Although the crop was damaged by dry weather, seed to plant about 5,000 acres was supplied to ARS. One grower had a crop yield of more than a ton of seed per acre.

Industrial applications for crambe oil look promising:

● In plant-scale tests by the steel industry, crambe oil has proved superior to rapeseed oil in continuous casting of steel. Rapeseed and palm oils are used to keep hot steel from sticking to the molds and cracking them. The chemical similarity of crambe and rapeseed oils led the Peoria scientists to propose crambe oil as a mold release agent.

● Evaluation of crambe fatty acids in two new kinds of nylon for brush bristles, wire coatings, pipe and tubing, films, and molded articles is being carried out under contract at Southern Research Institute, Birmingham, Ala. Nylon 13, made previously in laboratory quantities, and nylon 1313, which has not been made previously, will be produced and evaluated. The new nylons are expected to have better water resistance and molding characteristics than nylons now used.

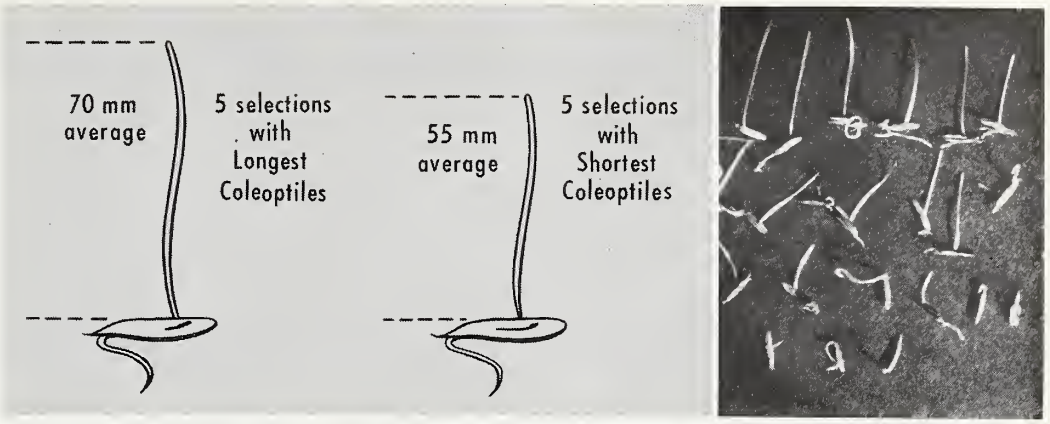
● Plasticizers for polyvinyl chloride (PVC)—a plastic used in raincoats, garden hose, shower curtains, refrigerator and freezer-door gaskets, and auto seatcovers—have been made at the Northern laboratory from crambe oil's fatty acids. These experimental plasticizers compare with commercial plasticizers in keeping PVC flexible at low temperatures. Five of the crambe products proved better than commercial plasticizers in protecting PVC against damage caused by intense light.

● New waxes, comparable with commercial beeswax, have been made at the Northern laboratory from crambe oil and its fatty acids. Wax made from crambe oil is glossy and white and melts at about the same temperature as beeswax—but it is much harder. Wax made from the fatty acids melts at a higher temperature but is not as hard as beeswax.

Experimental processing of crambe by Northern laboratory engineers showed that almost all the seed oil can be recovered by filtration-extraction, a process now used on cottonseed and, in Canada, on rapeseed. Industrial-scale trials show crambe can also be processed by pre-press-solvent extraction, a method often used with seeds of high oil content.

Chemists have found that oil in whole, undamaged crambe seed has good stability under practicable storage conditions and during normal processing. If the moisture level in flaked or damaged seed exceeds 15 percent, however, lipase activity begins to break the oil into fatty acids.

Research samples of crambe oil are available from the Northern Utilization Research and Development Division, USDA, 1815 North University, Peoria, Ill., 61604.☆



Germinated seeds (far right) put forth coleoptiles, which penetrate the soil surface. Long coleoptile seedlings (top row) will emerge from deep planting better than the ones with short coleoptiles.

Extending Seedling Emergence

Scientists aid dryland farmers by studying plant mechanism that penetrates soil surface

■ Many dryland farmers know from sad experience that failure of grass seedlings to emerge is a serious problem.

This failure often is due to a soil moisture condition a farmer can do little about: If he seeds at the regular planting depth, there isn't enough moisture to germinate the seed and support seedling growth; if he increases planting depth to place the seed in moist soil, the seedling may not be able to penetrate to the soil surface.

Development of varieties that can emerge from deeper plantings would be a great contribution to dryland grass production—and an important basic step in this direction has been taken by O. J. Hunt, ARS agronomist, and D. G. Miller of the Wyoming Agricultural Experiment Station.

Coleoptile penetrates soil surface

They found that a seedling of intermediate wheatgrass emerged better from deep planting if it had a long coleoptile—the part of the seedling that makes the first penetration of the soil surface. The coleoptile clears the way for the first true leaf, which is extremely delicate. If the coleoptile isn't long enough to reach the soil surface, the first leaf won't emerge.

After analyzing data obtained from several experiments, Hunt and Miller concluded there is a strong correlation between seed size, coleoptile length, emergence from 3-inch depth, and seedling height. Their findings also indicate that it should be possible with relatively simple breeding techniques to develop varieties with long coleoptiles.

Hunt and Miller planted intermediate wheatgrass seed taken at random from bulk seed of 20 selections. The five selections with the longest coleoptiles (about 70-millimeters average) also produced the heaviest open-pollinated seed, the weights varying from 1.59 to 1.94 grams for each lot of 200 seeds. The five selections with the shortest coleoptiles (about 55-mm. average) produced seeds averaging about 1 gram per 200 seeds.

Emergence of seedlings from the 3-inch planting depth ranged from 75 to 98 percent for the five selections with the longest coleoptiles, and from 35 to 48 percent for the five selections with the shortest coleoptiles. Seedling height ranged from 86 to 106 mm. in the five selections with longest coleoptiles, and from 55 to 80 mm. in the five selections with the shortest coleoptiles.

Can improve emergence by selection

Results of crossing experiments indicated that improvement of coleoptile length, emergence potential, or seed size can be accomplished through simple maternal-line selection using open-pollinated progeny.

The prospect of developing long-coleoptile, large-seeded varieties is brightened by the fact that the Wyoming scientists found a wide range of these characteristics within the very small amount of plant material they tested. Breeders should find considerably wider ranges as they increase the number of selections—and the wider the range, the greater is the chance of incorporating the desired characters in new varieties.☆

ANTS VERSUS ANTS

Freeloading South American parasite pays no room and board—could outwit, control South's imported fire ant

A parasite that appears to outwit the fire ant and help keep it under control has been found in some areas of Uruguay and Argentina. It is another ant—one that lives in fire ant mounds and tricks its host into feeding it and rearing its young.

This discovery could be useful in the control of the imported fire ant (*Solenopsis saevissima richteri*) in the United States. However, the United States will not import the parasite from Uruguay until there is further confirmation that it will not damage anything except the fire ant (*S. s. richteri*) and until there is evidence that it can survive in the Southern United States, where the imported fire ant has become a serious pest of people, crops, livestock, and wildlife and where its mounds damage farm machinery.

The fire ant is not a serious problem in certain areas of its native Uruguay. This led United States and Uruguayan entomologists to theorize that something in the ant's natural habitat in those locations keeps its numbers down.

For the last 3 years, under a grant awarded by ARS, Uruguayan scientists of the Faculty of Agronomy, University of the Republic in Montevideo, have conducted laboratory and field studies on fire ants in Uruguay, Argentina, and Brazil. They are determining what effect different weather conditions, altitudes, insects, mites, birds, and animals have on fire ant numbers and activity.

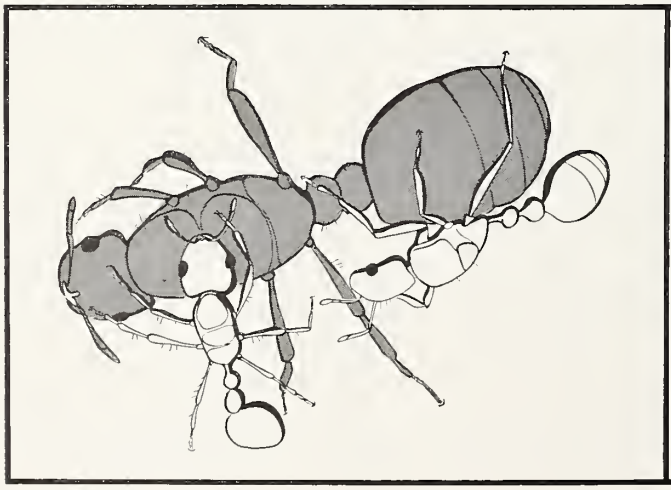
They found that social parasites frequently inhabit the mounds of fire ants. The most important of these parasites is another ant, *Labauchena daguerrei,* which lives entirely at the expense of the fire ant (*S. s. richteri*) and keeps down the number of ants and strength of the fire ant colony without apparently ever completely destroying the colony.

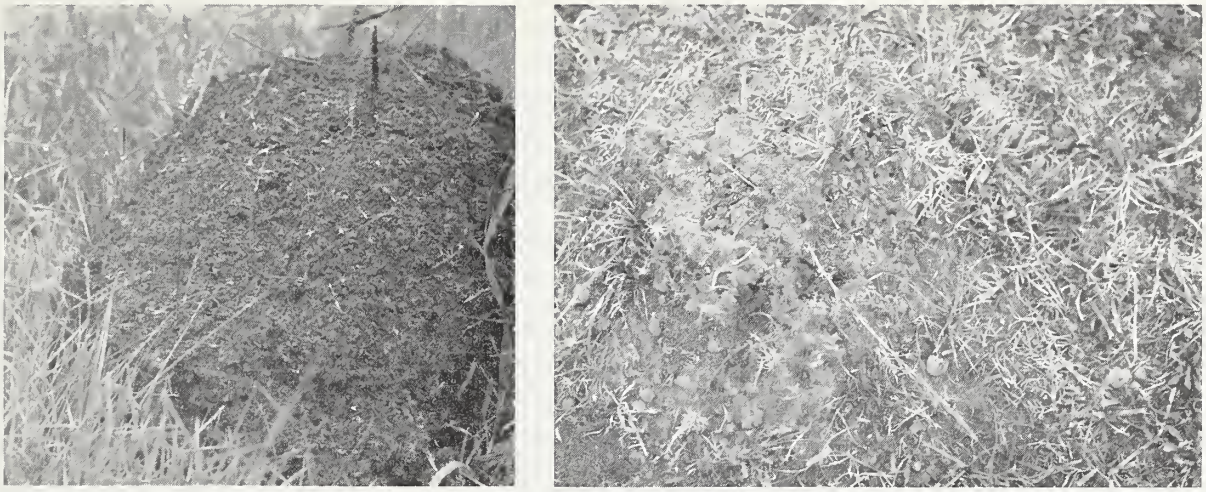
The fire ants neglect their own kind to give the parasitic ants food, space, and care—from the time the eggs are laid until the adult parasite females mate and leave the nest. The males of the parasite remain in the fire ant nests and die there.

The Uruguayan scientists—A. Silveira-Guido, P. San Martin, C. Crisci, and Joaquin Carbonell—are still studying the parasitic ant intensively, in the laboratory and in the field, to determine, among other things, whether it has any other host besides the fire ant. So far the parasite has been found only where fire ants are found.

They have already shown that the parasite is a specialized ant that feeds

As an initial step in occupying a fire ant mound, parasite queens (the smaller ants) capture and hold the fire ant queen prisoner in her own mound. The parasite queens—it may take as many as five—entwine their mandibles around the queen's neck and their legs around her body.





The effect the social parasite ants have on an imported fire ant mound is apparent when comparing a mound that is free of the parasites (left) with one that is in an advanced stage of attack by the parasites (right).

on neither animals nor plants—just on the regurgitations of its host. In laboratory experiments, the parasites starved to death when they were left without fire ant workers to feed them—even though honey, powdered milk, and ham fat were placed nearby.

The parasite's body has been modified by Nature so that it is uniquely suited for parasitizing the fire ant. Its mandibles are shaped and smoothed so they fit a certain place on the fire ant queen's neck without hurting or killing the queen. The legs of the parasite are too weak for much walking, but they are ideally suited to immobilizing the queen.

The parasite colony, which has no workers, is made up of males and females. There are two forms of the females—a form that apparently has no assigned duties inside the nest and another form that loses its wings and becomes a queen holder and egg layer. Generally, two queen holders attach themselves—one on each side—to a fire ant queen; the queen doesn't try to defend herself.

When a parasite comes near a fire ant worker in the nest, it rapidly flutters its antennae, and the fire ant then feeds the parasite by regurgitating food into its mouth. When a fire ant worker starts to feed a queen that has a parasite attached, the parasite flutters its antennae and the worker feeds the parasite instead of the queen. The workers also clean and polish the parasites the same as they do the fire ant queens.

One of the most important discoveries that the Uruguayan entomologists have made about the parasite *L. daguerrei* is that two of its major reproduction cycles coincide with those of the fire ant. While the female parasites are holding a fire ant queen that is laying eggs, they also lay eggs. Fire ant workers gather all the eggs—those of the queens and those of the parasites, package them together in saliva, and store them near the queen or near the water source in the ant mound. The special brood workers give the same careful attention to rearing the young parasites through the various stages as they do to rearing the fire ants.

As soon as the adult parasites mate, in late August, which is springtime in Uruguay, the males (only about 15 percent of the parasite colony) die, and the females fly to another colony of fire ants and repeat the parasitization process.

In 1963, the Uruguayan scientists studied 45 parasitized fire ant colonies, all of which showed some degree of decline. The comparative vigor of the fire ant colony depended on the number of parasites in it. The scientists also found a marked decrease in the number of broods in parasitized fire ant colonies. In all cases where parasites were present, the mound crusts were eroded, weeds were growing on the mounds, and the bases of the mounds had not spread.

In the same localities, fire ant mounds that were not parasitized had a hard crust on them and contained large numbers of larvae.

The research in Uruguay was supported by a grant awarded by ARS under Public Law 480, which authorizes the sale of U.S. surplus agricultural products abroad. The foreign currencies received from the sales cannot be converted into dollars for use in the United States, but a portion of the money can be used as grants to pay for foreign research that will benefit U.S. agriculture.☆

Growth Regulator Protects Cabbages . . .

At temperatures as low as 1° below zero

■ Treatment with a growth-retarding chemical gave young cabbage plants of a late-maturing variety complete protection against frost damage in ARS tests at Beltsville, Md.

And when the chemical was applied at a strength of 2,500 parts or more per million, it not only suppressed flowering but each plant formed a solid head the following spring.

Physiologist P. C. Marth treated the plants with a growth retardant in mid-October and kept them outside in temperatures as low as −1° F. until early March.

All the treated plants survived freezing and resumed growth from vigorous terminal buds when brought into a warm greenhouse in the spring. Sixty percent of an untreated group were frozen and killed. The surviving untreated plants grew slowly and poorly, many of them from lateral buds because their terminal buds had been killed.

Previous tests by Marth and others have shown that plants treated with growth retardants are more resistant to wilting, soil salinity, heat, and cold than untreated plants. Susceptibility to these conditions is directly associated with the physical state of water molecules in the plant cells. Frost damage, for instance, results from relatively large, sharp-pointed ice crystals that form in the cells and puncture the cell walls.

Scientists do not have complete answers on how growth retardants increase cold resistance. But they do know that retardation in plant growth increases the content of pentosan, a sugarlike substance, in plant cells. The pentosan combines with free water, much the way gelatin does, and the combined water has a lower freezing point than free water.

Also, the liquid part of the plant cell is denser and the cell walls are thicker in treated plants than in untreated plants, characteristics that may further lower the freezing point of the treated plant.

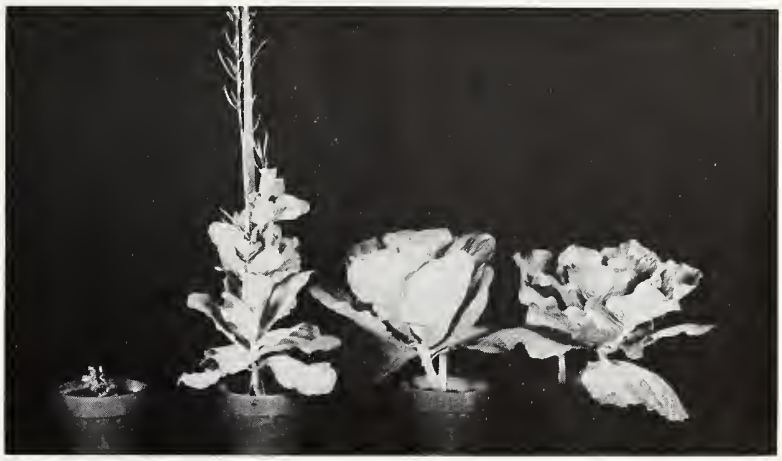
Previous studies have also shown that growth retardants influence flowering of some ornamental and crop plants (AGR. RES., September 1964,

All but one of the untreated cabbage plants (front row) died; in contrast, the treated plants (back row) survived. All of these plants were kept outdoors all winter in temperatures as low as −1° F.

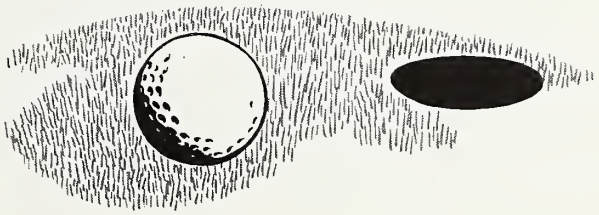
pp. 8–9; November 1964, p. 3). In Marth's recent tests with cabbage, he found that although a high dosage suppressed flowering, a low dosage increased flowering. All cabbage plants treated with 626 p.p.m. retardant flowered in the spring, but none of the group treated with 2,500 p.p.m. flowered. Only about half of the untreated plants flowered.

The retardant, N-dimethylamono succinamic acid, is an experimental spray being tested on vegetable and other crop plants. It has not been recommended or approved for use by vegetable growers.☆

Plants stored outdoors all winter were (left to right) untreated and treated with 626 p.p.m. retardant, 2,500 p.p.m., and 5,000 p.p.m.



A New Grass for Golfers



■ Golfers who like fast greens will benefit from a new bermudagrass with tiny blades that hug the ground closely.

The new grass, named Tifdwarf, has been rated equal or superior to Tifgreen as a golf-green grass on nearly every score in tests at the Georgia Coastal Plain Experiment Station at Tifton.

Tifdwarf is believed to be a mutation of Tifgreen, which was developed jointly by ARS and the Georgia station and has been rated as the top golf-green grass for the South since its release in 1956.

Tifdwarf is being released officially to qualified nurserymen this spring through the Georgia Crop Improvement Association and similar certification outlets in other States.

Blades of the new grass hug the ground so closely that a number of them are never cut by the greens mower. This trait helps Tifdwarf tolerate a $\frac{3}{16}$-inch cutting height much better than Tifgreen. Its softer blades and fewer seedheads also help to make it desirable for use on putting greens.

Tifdwarf should require less mowing and less topdressing than Tifgreen to maintain a smooth, attractive putting surface. Although both grasses appear to be equal in disease resistance, Tifdwarf showed a little more winter hardiness in tests at Beltsville, Md.

How Tifdwarf originated, no one will ever know for sure. It was first discovered growing in test greens on golf courses at Sea Island, Ga., and Florence, S.C. These greens were planted to Tifgreen as part of its evaluation before being released from the Tifton station.

Officials at the two golf courses noticed a small circle of fine grass growing on the test greens. Plugs of the grass from both golf courses were sent to Tifton plant breeders, who planted the plugs for evaluation tests. Tifgreen and two other grasses were used as checks.

G. W. Burton, ARS plant geneticist at Tifton, reports that evaluation of all evidence indicates that Tifdwarf is a vegetative mutant of Tifgreen that occurred at Tifton before the first planting stock was sent out for early testing. Apparently, the golf courses at Florence and Sea Island each got a sprig or two of the mutation. Tifdwarf's superior spreading ability allowed it to compete against Tifgreen under golf-green maintenance until it occupied an area about 18 inches in diameter on each green.

As Burton points out, the exact origin of Tifdwarf is not too important. It has been isolated, purified, named, and thoroughly tested. Now the golf-course superintendent and the golfer must determine if it is really better than Tifgreen.☆

Oriental Fruit Flies . . .

GONE FROM GUAM

Release of sterile flies is successful in causing self-destruction of fly population

■ ARS entomologists have used the male sterility technique to eradicate a small population of oriental fruit flies from the island of Guam.

This method, which uses the insects themselves for their own destruction, consists of rearing, sterilizing, and releasing vast numbers of insects into the wild insect population. When the ratio of sterile to fertile males becomes high enough, reproduction ceases and the species dies out. ARS scientists did the basic research that led to the development of the male sterility method.

Ideally, entomologists employ the male sterility technique when the population of the target insect is at a low point or is concentrated in a small area. Both of these conditions existed on Guam in the late summer of 1963, after two typhoons greatly reduced the oriental fruit fly population. (The typhoons destroyed most of the island's breadfruit and other fruit crops, which provide the insect's food sources there.)

Flies were concentrated in small area

Of the relatively few oriental fruit flies remaining, over 90 percent were concentrated on and near Tarague Beach, along a 2-mile front at the extreme northeast tip of the 210-square-mile island.

Taking advantage of this low concentration of fruit flies, ARS entomologists, with the cooperation of the government of Guam, released 1.2 million sterile flies from ground cages at five points in September 1963. This particular strain of fly had been reared and sterilized by gamma radiation at the USDA laboratory in Hawaii. One of the purposes of the release was to study the distance the fly travels, its length of life, and its ability to compete in mating.

The flies, marked with blue dye for identification, spread throughout the northeast 75 square miles of Guam, overflooding the wild population. At the end of a month, only a few wild flies were picked up in traps located at strategic points around the island. Additional blue-dyed sterile laboratory flies were then released during the next several weeks.

Not a single wild fruit fly was caught in the traps until March 1964, when one fly was caught in each of two villages in south Guam. Weekly releases of 100,000 to 300,000 sterile flies were begun in an attempt to keep Guam free of the destructive pest. No more wild flies were found until August 1964, when two were trapped. Again, weekly releases of 78,000 to 1 million sterile flies were made for 7 weeks to prevent reestablishment of the fruit fly. No additional wild flies have been found since that time, and

Prior to the eradication campaign, a typhoon destroyed most of the bread fruit trees and other fruits on Guam, eliminating the fruit fly's food sources and greatly reducing the fly population.

Guam is considered free of the pest.

The wild flies trapped during 1964 are believed to have been brought into Guam in untreated mangoes or other host fruits. A quarantine has been established to prevent future importation of host fruits.

Cost: less than 4 cents an acre

Altogether, about 20 million sterile flies were released, and the overall cost of eradication was less than 4 cents per acre. There is no estimate of the cost that might have been involved had eradication been attempted by the bait spray method. But insect control by chemical means often is as costly when insect populations are low as when they are high. In contrast, the sterile insect release method, as employed on Guam, costs less when the insect population is low.

The oriental fruit fly has never become established in the continental United States, but California fruitgrowers have long considered it one of the greatest potential threats to their industry. If the pest were to become established on the mainland, the male sterility method would be especially useful while the fly population was still low.

Can lure flies to sterilant

A larger, "normal" fruit fly population might be more economically eradicated by the method used on Rota, an island 37 miles north of Guam (AGR. RES., November 1963, p. 3). In this effort, ARS entomologists used a chemical sex attractant to induce male flies to eat an insecticide; annihilation of the males caused the destruction of the entire population. The chemical was attractive only to male fruit flies and posed no hazard to birds, wildlife, or desirable insects. The male annihilation method was highly effective and, in this instance, was more economical than the sterile male technique.☆

CAN WE UTILIZE DUST?

A network of gaging stations, 13 in all, is located in 9 States to collect dust and provide information on its movement.

■ From the Kansas-Colorado border eastward to New Jersey—and from Montana southward to Texas—ARS soil scientists and cooperators are measuring dust deposited from the atmosphere.

Since this dust contains minerals and organic matter, efficient methods of trapping and holding it on agricultural land could increase soil fertility.

But to utilize the atmospheric dust as a natural resource, scientists must understand dust movement in the atmosphere—where it comes from, in what direction and quantities it moves, and how far it travels.

Because similar quantities of dust are deposited each month at Manhattan, Kans., ARS soil scientist R. M. Smith and Kansas State University geologist P. C. Twiss reasoned that specific areas—perhaps regions—may have a normal, constant rate of dust influx. To find out, they were instrumental in establishing a network of 13 gaging stations east of the Rockies to measure the amount and characteristics of dust flowing into specific areas.

States cooperating in the research, besides Kansas, are Mississippi, Missouri, Montana, Nebraska, New Jersey, New York, Ohio, and Texas.

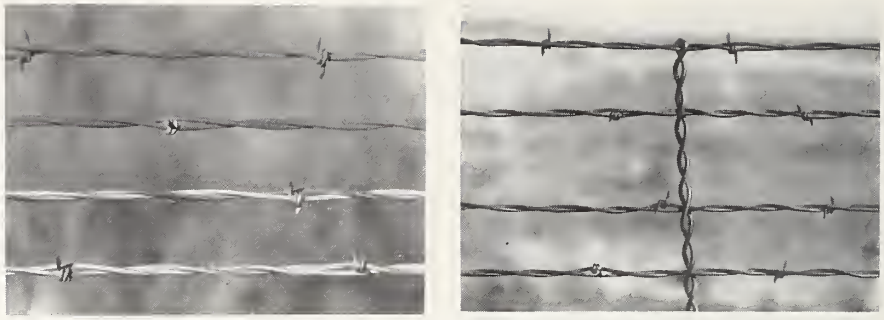
The scientists have adapted to their work the concept used to determine minimum or base flow of streams. The amount of dust flowing into an area during clear, apparently dust-free weather is the base rate of dust influx for the area. Increases in dust influx over this base rate can be compared to the amount of water in a stream above the minimum flow.

For example, an average of 40 pounds of dust per acre was deposited at Manhattan during 11 months in 1963 and 1964. During April and May 1964, however, the monthly average was 119 pounds per acre, a dust "flood" that occurred at the same time as duststorm activity 300 miles away on the Kansas-Colorado border. And in June, the dust deposited at Marcellus, N.Y.—1,300 miles from the storm—increased from 33 to 58 pounds per acre.

In cooperation with the U.S. Weather Bureau, the scientists hope to trace the course and distribution of well-defined duststorms that pass through the dust bowl. Tracing the storms may also help explain the origin of loesses—unstratified soil formations—that make up a large part of our midwestern soil. Loesses are generally thought to be dust and other windborne materials that have been deposited over thousands of years.☆

Protect Fencing...

By grounding to reduce deterioration by lightning



Fencing built in 1941 shows how grounding protects against deterioriation caused by lighting. The ungrounded fence (left) is rusted and has lost its temper; grounded fence (right) retains its galvanized coating.

■ ARS studies at Woodward, Okla., show that thorough grounding will reduce lightning damage to barbed-wire fences. By a form of electrolysis, lightning deteriorates the galvanized coating on ungrounded fences, leaving the wires to rust.

Scientists observed the effects of lightning on several sections of barbed-wire fence built in 1941. Sections with no grounding, except that provided incidentally by corner braces, posts, and holddown wires in low places, had been damaged considerably by 1955 and were badly deteriorated by 1963.

The top strand of wire was severely rusted and pitted, had lost much of its temper, and was slack in many places. The second strand was partly rusted, the third had a dull galvanized finish, and the bottom wire showed little deterioration. The lower wires were believed to have been grounded to some extent by brush and weeds.

By contrast (see photos), a section of fence that was grounded with twisted wire stays at regular intervals between posts still had protective galvanized coating on all wires in 1963.

An electrical transmission line, which was run directly above a section of ungrounded fence in 1948, apparently protected the fence from lightning damage. The fence still had its galvanized coating intact in 1963.

Although the optimum spacing for ground wires has not been scientifically determined, the scientists have observed that grounding is adequate when stays are placed every 16 to 20 feet (midway between posts in most fences in the West). The stays, of twisted wire in firm contact with the soil, make fencing sturdier.☆

Comparing Forage Pellets

■ Dehydrating, grinding, and pelleting of alfalfa now require about 30 percent more energy than similar processing of Coastal bermudagrass. But alfalfa pellets, being denser, are more durable and less likely to crumble in handling.

ARS agricultural engineer J. L. Butler reported these findings at the Georgia Coastal Plain Experiment Station in Tifton, where scientists are trying to produce Coastal bermudagrass pellets that can be priced competitively with other forage pellets.

When considering the pelleting operation only, alfalfa and other legume pellets are easier and less expensive to produce than are either grass or grass-legume mixtures.

Alfalfa is the most widely used crop for making pellets, although Coastal bermudagrass is becoming increasingly popular. This is primarily because Coastal bermudagrass can be produced with an acceptable protein content and it is better adapated to the Southeast than alfalfa (AGR. RES., February 1965, p. 4).

Butler used three basic pieces of processing equipment in his comparison study: A dehydrator for extracting moisture, a hammermill for grinding, and a pellet mill for mixing moisture with the ground forage and for pelleting. In order to use identical units in computing total energy, he converted gas B.t.u.'s of the dehydrator into equivalent killowatt-hours of the hammermill and pellet mill.

Alfalfa required more energy in the first two processing steps—dehydrating and grinding. In dehydrating, the alfalfa contained a larger amount of water which had to be removed; in grinding, the bigger alfalfa particles did not slip through the screen into the pellet mill as quickly, and so were subject to a longer grinding action.

At the pelleting stage, however, Coastal bermudagrass required about 45 percent more energy than did alfalfa. This narrowed the difference in total energy to about 30 percent.☆

How do oats subdue peanut blight?

Why is southern blight of peanuts less severe when the crop is grown in rotation with oats?

Cooperative studies by ARS and the Alabama Experiment Station point to two possible explanations: (1) Water-soluble substances that occur naturally in oats have a suppressive effect on the fungus, and (2) soil micro-organisms that decompose oat residues increase in number and activity during the decomposition process, and they either destroy or suppress the fungus.

ARS agronomist A. C. Mixon and Alabama plant pathologist E. A. Curl conducted the studies at Auburn.

Southern blight, or "white mold," is caused by a soil fungus, *Sclerotium rolfsii*, which attacks the roots and soil-level parts of peanuts and a wide range of other host plants. The fungus for southern blight has a capacity for surviving long periods in the soil.

The disease is usually most severe where peanuts are planted following peanuts or other legume crops; it is less severe where oats, corn, or other grain crops are planted in rotation with peanuts.

In one test, the scientists grew the fungus in sterilized water extracts of clover, peanut, vetch, corn, and oat residues. Growth of the fungus was considerably less in oat and corn cultures than in clover and peanut cultures.

In another test, the scientists grew the fungus on small squares of nylon gauze, then buried the squares in natural and sterilized soil containing chopped clover or oat residue, or no residue. Disappearance of the fungus occurred most rapidly in the soil containing oat residue.

Fungus reduction was much greater in natural soil than it was in the sterilized soil. The scientists reason that certain micro-organisms in the natural soil may have been activated by the presence of the chopped residue. These micro-organisms then suppressed and destroyed the fungus.

Dye-marked flies easily identified

A new method of identifying dye-marked insects is speeding research on the male-sterility technique of insect control.

This new method is being used in the Mariana Islands to distinguish laboratory-sterilized fruit flies that are marked as pupae with an oil-soluble dye, released in the field, and later trapped along with flies of the natural population.

The Pacific tests are an important part of ARS research in which scientists are seeking additional information on the use of sterilized fruit flies to reduce fly populations and ultimately eradicate these destructive crop pests by biological means (AGR. RES., August 1963, p. 5).

Since sterilization does not alter the appearance of insects, the researchers needed a quick, effective way to identify the released flies so they could determine dispersal, length of life, and overflooding ratios (numbers of sterile flies compared with native flies). This information is necessary also in evaluating progress in eradication campaigns that employ the male-sterility technique.

ARS entomologist L. F. Steiner of Honolulu developed the new identification method. Following his procedure (see photo), a technician places 50 or more flies on a sheet of filter paper over a flat glass surface, then dips a small carriage bolt in acetone and crushes each fly's head. If marker dye is in the fly, it is transferred to the paper. Identification can be made as fast as the bolt is moved from acetone to insect and back again.

With this new method, it was possible to identify and record time and place of capture of 300,000 fruit flies that emerged from the 60-odd million dyed pupae released on the island of Rota. Nearly twice as many identifications can be made in a given time as is possible with a previously avail-

Sterilized fruit flies that have been marked with an oil-soluble dye are identified rapidly with a carriage bolt and acetone.

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able procedure, in which each trapped insect is placed separately in a small cup with a strip of chromatographic paper and acetone. This cup procedure was too slow and impractical for identifying the thousands of fruit flies recovered in the 1,800 trap collections made in the Marianas.

Seeding reduces runoff 93 percent

Retirement of marginally productive cropland to permanent vegetation has reduced surface runoff nearly 93 percent on experimental watersheds in the central Great Plains. For several years, conservationists have recommended reseeding such lands to perennial prairie grasses, but little experimental evidence was available on how this would affect surface runoff and soil loss.

To get research data. ARS investigators seeded adapted prairie grasses on watersheds near Hastings, Nebr., that had been continuously cultivated for 50 to 60 years. The studies, by soil technician W. L. Rice and hydraulic engineer F. J. Dragoun, are cooperative with the Nebraska Agricultural Experiment Station.

In only 2 years, runoff was reduced to 0.26 inch annually—from an average of 3.70 during the period 1941–54, when the watersheds were in cultivation. Although it is too early to say whether this reduction will be maintained, it does indicate the far-reaching effects reseeding could have on runoff, surface water supply, and probably underground water supply.

The watersheds were first seeded to grain sorghum. Then in the fall, after frost had killed the sorghum, a grass mixture was planted without further ground preparation. The grass mixture consisted of western wheatgrass, big bluestem, little bluestem, blue grama, sideoats grama, switchgrass, and Indian grass. The perennial grasses, sorghum residue, and volunteer annual plants provided almost complete soil cover.

The annual runoff of 0.26 inch on these watersheds compares favorably with a runoff of 0.22 for another watershed which has been in native grass since 1937. A similar watershed that had been in cultivation and was unprotected had a runoff of 5.43 inches. All the watersheds were about 4 acres.

Camera records tobacco curing

A time-lapse camera loaded with color film is providing a round-the-clock "eye" for watching color changes that occur in Kentucky tobacco leaves as they cure.

ARS and Kentucky Agricultural Experiment Station scientists hope accurate records of rate of color change will help explain how and why color changes occur. Understanding the process is important because color is one of the best indicators of quality in the end product.

Agricultural engineer W. H. Henson, Jr., of ARS directed the construction of a camera-turntable system to photograph individual leaves of curing burley tobacco. A leaf is placed inside each of six test cabinets—with glass fronts—and subjected to various combinations of air temperature, airflow, and moisture content. The camera automatically photographs each leaf once an hour to record the effect of these conditions on the rate of color change.

During a test, the cabinets are arranged in a circle around the camera, which is mounted on a turntable operated by a small electric motor. As the camera passes each cabinet, the shutter and flash gun are triggered automatically.

Henson has used two methods of analyzing the film. In one method, he studies the series of photographs and makes a subjective analysis of how much of the leaf reaches the yellow stage at any given time. In the other, he places the developed film in the measuring beam of a spectrophotometer. Measurements made by the spectrophotometer have thus far proved to be less dependable because of variations in film, film development, and light exposure.

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